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ABSTRACT

Agricultural and natural resources education in two-year colleges is examined as revealed by a study of science education that involved: (1) a review of the literature, (2) an examination of 175 college catalogs and class schedules from colleges nationwide, and (3) a survey of 1,275 science teachers. Part I of the study report discusses agriculture and natural science curricula in terms of the number of courses listed in the catalogs for each of eight categories: agriculture (general), animal science, plant science, soil science, natural resources (general), forestry, wildlife and wildlands, and food science. Data tables outline course offerings by college region, type of control, and size; the percent of courses in each category by instructional mode; and the percent of courses with prerequisites. Part II discusses the results of the faculty survey, providing information on agriculture and natural resources faculty, students, course goals, instructional activities, grading and testing, instructional materials, and course improvement. Part III presents summary statements pointing to the growth of agriculture and natural resources programs and the need to improve basic science and math prerequisites, communication skills of students, and the use of media in agriculture instruction. The survey questionnaire is appended. (JP)

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Science Education in Two-Year Colleges

AGRICULTURE AND NATURAL RESOURCES

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SCIENCE EDUCATION IN TWO-YEAR COLLEGES:
AGRICULTURE AND NATURAL RESOURCES

by

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February 1980

Center for the Study of Community Colleges

and

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PREFACE

This monograph is one of a series of twelve publications dealing with the sciences in two-year colleges. These pieces are concerned with agriculture, biology, chemistry, earth and space sciences, economics, engineering, integrated social sciences and anthropology, integrated natural sciences, mathematics, physics, psychology, and sociology. Except for the monograph dealing with engineering transfer programs each was written by staff associates of the Center for the Study of Community Colleges under a grant from the National Science Foundation (#SED 77-18477).

In addition to the primary author of this monograph, several people were involved in its execution. Andrew Hill and William Mooney were instrumental in developing some of the procedures used in gathering the data. Others involved in tabulating information were Miriam Beckwith, Jennifer Clark, William Cohen, Sandra Edwards, Jack Friedlander, and Cindy Issacson.

Field Research Corporation in San Francisco, under the direction of Eleanor Murray, did the computer runs in addition to printing the instructor survey employed in that portion of the project dealing with instructional practices. Bonnie Sanchez of the ERIC Clearinghouse for Junior Colleges and Janice Newmark, Administrative Coordinator of the Center for the Study of Community Colleges, prepared the materials for publication. Carmen Mathenge was responsible for manuscript typing. Jennifer Clark did the final compilation of the various bibliographies for each monograph.

Florence B. Brawer coordinated the writing activities and edited each of the pieces. Arthur M. Cohen was responsible for overseeing the entire project.

In addition to these people who provided so much input to the finalization of this product, we wish to thank Edward C. Frederick of the University of Minnesota who reviewed the manuscript and Ray Hannapel and Bill Aldridge of the National Science Foundation, who were project monitors.

Arthur M. Cohen
Project Director

Florence B. Brawer
Publications Coordinator

SCIENCE EDUCATION IN TWO-YEAR COLLEGES:

AGRICULTURE AND NATURAL RESOURCES

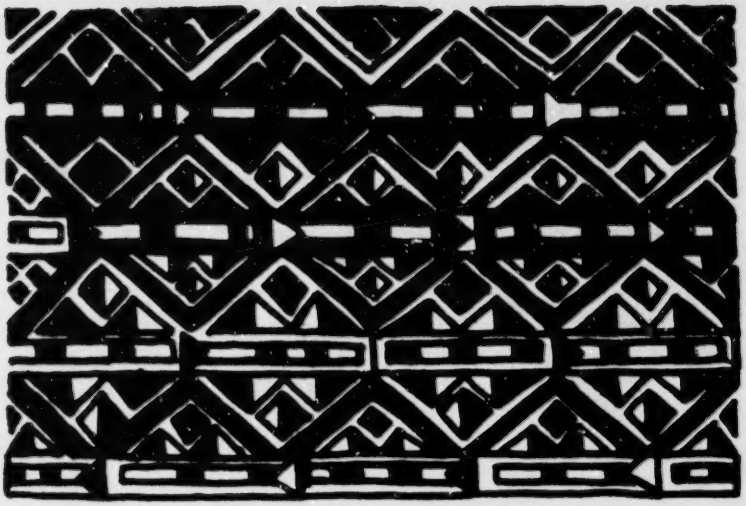
Two-year community and junior colleges enroll more than four million students, one-third of all students in American higher education. Current figures show that 40 percent of all first-time, full-time students are in two-year colleges. Add to this number the people beginning college as part-time students and those attending the two-year college concurrently with or subsequent to enrolling in a senior institution, first-year students taking two-year college courses then approximate two-thirds of all freshmen. These students are enrolled in a wide range of courses--transfer, occupational, remedial, continuing education, community service, and terminal degree. Coming from all walks of life and different cultural and ethnic backgrounds, they represent a wide range of ages.

Despite the awareness of both size and diversity, many questions exist regarding the ways that two-year college science curricula address these challenges. For example, how many students are enrolled in science courses? What science disciplines and what courses are most frequently found in two-year colleges? Do courses vary in different types of institutions or in different regions of the country? Do courses that are ostensibly the same have similar course goals and content, or do student and faculty predilections stimulate variety? Do instructional practices reflect the needs and interests of a heterogeneous student body, or do they mirror the traditional practices of four-year college and university science courses?

Under a grant from the National Science Foundation (NSF), the Center for the Study of Community Colleges has been involved in a study of curriculum and instruction in two-year college science and science-related technology programs. The disciplines under the purview of NSF and included within this study were agriculture, biology, engineering, mathematics, chemistry, earth and space sciences, physics, interdisciplinary

science, anthropology, psychology, sociology, and economics. Three separate but interrelated activities were involved: a literature search was conducted for each discipline, curriculum data were gathered, and instructors were surveyed to determine instructional practices. These activities were conducted in order to answer questions held by those involved in science education on the institutional, district, state and national levels and to provide the science education community with a base line of data that may be used by future researchers investigating changes and trends in curriculum and instruction in the sciences in two-year colleges.

This monograph is concerned with the scientific aspects of agriculture and natural resource education in two-year colleges. It is divided into three parts: the curriculum study, the study of instruction, and conclusions. In the first sections on curriculum and instruction, the appropriate literature is interwoven with the findings of our study.



PART I

THE CURRICULUM STUDY

Our interest in conducting these studies for the National Science Foundation centered on the scientific content in agriculture education--not the occupational or vocational. Our focus was at the course level, not at the program level. The literature, however, centers on programs. Programs are examined for their transferability, for their comparability within a state, and, most frequently, for their occupational content and relevancy. The literature concentrates on three major areas of curricular concern. First, there is the literature that focuses on the role of the two-year programs vis-a-vis high school programs and four-year institutions --in other words, on the need for program articulation. The second major topic relates to the programs themselves--transfer, technical, vocational,

or adult--and the success with which these programs meet the needs of students who are either transferring to four-year institutions or in job placement. Tied in with this topic are the various studies that survey the number of programs offered, student enrollment, and faculty employed. The third area describes the types of courses that should comprise a program and, particularly, the balance between technical and general education courses, between work experience and theoretical courses, and between courses in science and agriculture courses. While the above discussion compartmentalizes these three areas into discrete categories, within the literature they tend to be interwoven.

METHOD

In order to establish a base line of information regarding curriculum in the sciences in two-year colleges, and specifically here--information about agriculture and natural resources--special sampling and data-gathering procedures were established.*

The Sample

The first step was to assemble a representative sample of colleges. The starting point was an earlier study by the Center for the Study of Community Colleges for the National Endowment for the Humanities. This study had already assembled a sample (balanced by college control, region and size) of 178 colleges. Using this sample as the initial group, the presidents of these colleges were invited to participate in the current study. Acceptances were received from 144 of these schools.

A matrix was then drawn with cells representing nine college size categories for each of six regions of the country. Using the 1977 Community, Junior and Technical College Directory (AACJC, 1977), the ideal size/region breakdown for a 175-college sample was calculated. The remaining 31 colleges were selected by arraying all colleges in the under-represented cells and randomly selecting the possible participants.

*For a complete report of the procedures used in this study, see Hill and Mooney, 1979, Eric Document Number 167 235.

The sampling technique used in this study produced a balanced sample of 175 two-year colleges. The following table shows how close our sample is to the percentage breakdowns of the nation's two-year colleges. (A regional list of participating colleges is found in Appendix A.)

Table 1

Percentage of 175-College Sample Compared to Naticnal Percentages by Size, Region and Control

	Size								
	1-499	500-999	1,000-1,499	1,500-2,499	2,500-4,999	5,000-7,499	7,500-9,999	10,000-14,999	15,000+
National %	15	18	13	17	17	8	5	5	4
Sample	13	16	13	17	19	9	5	6	4

	Region					
	Northeast	Middle States	South	Mid-West	Mountain Plains	West
National %	7	13	32	21	10	17
Sample	6	12	31	22	13	16

	Control	
	Public	Private
National %	84	16
Sample	84	16

Procedure

College catalogs and class schedules for the 1977-78 academic year were obtained from each of the 175 colleges participating in this study. For the curriculum phase a three-level method of classifying courses was employed. First, based upon the catalog course description, each of the science courses was placed into one of six major curriculum areas:

Agriculture and Natural Resources, Biological Sciences, Engineering Sciences and Technologies, Mathematics and Computer Sciences, Physical Sciences, and Social and Behavioral Sciences. These areas were chosen because they closely reflect the instructional administrative organization of two-year colleges as well as the organization of national and international professional science organizations and agencies such as the National Science Foundation.

The second level of classification was based upon the major subject field disciplines within the broad area. Closely related courses were placed into categories based on catalog descriptions of subject matter. In order to be included in this study of science and science technology education in the two-year college the course description had to meet certain criteria. These criteria had been established at the onset of the study to conform with the National Science Foundation guidelines on science and to provide internal consistency in the selection of courses for all the disciplines.

The major criteria were that courses had as their primary focus the acquisition of knowledge based on scientific fact, theory, and principles and that skills and/or practical application of scientific knowledge were of secondary importance. With these criteria a number of offerings under agriculture and natural resources which emphasized mechanics, field practice and projects, production, business, training of animals, clinical work, and hands-on experience were omitted. However, courses offered under other departments could be included (e.g., a class in turf management offered by the recreation department or a course in soils offered under biology or civil engineering) provided they met the above criteria.

The categories that were formed and the subdivisions within each are:

Agriculture-General
- Intro/Orientation
- Pests and Their Control
- Agriculture Engineering

Animal Science
- Animal Science
- Animal Breeding
- Animal Nutrition
- Animal Health
- Animal Husbandry

Plant Science
- Plant Science
- Agronomy
- Horticulture
- Ornamental Horticulture
- Greenhouse
- Plant Pathology

Soil Science
- Soil Science
- Irrigation/Fertilization
- Soil Mechanics

Natural Resources

Forestry
- Introduction
- Forest Sciences
- Forest Technology
- Forest Products

Wildlife and Wildlands
- Fisheries
- Wildlife
- Range
- Wildlands
- Water

Food Science

(A complete description of these categories is found in Appendix B).

After all courses were classified for the 1977-78 academic year, class schedules were examined and the number of sections offered (day, evening, and weekend credit courses) for each term was determined. Prerequisites, and instructional modes (e.g., lecture, lecture-lab) were determined.

RESULTS

Two-thirds of the colleges list at least one of the designated courses in their catalogs and 61 percent offer at least one course during

the academic year. Table 2, developed from the procedure described above, presents an overall view of the agriculture and natural resource curriculum offered in two-year colleges for the 1977-78 academic year.

In examining the specific types of courses that colleges list in their catalogs and actually schedule, we found that the most popular courses were in plant and soil science followed by animal science and agriculture-general courses (Columns 1 and 2). In terms of the total number of courses listed in the schedule, however, there were more animal science classes than soil science (Column 3). Our analyses also indicated that relatively few institutions include courses in the areas of natural resources and food science and even fewer actually scheduled them during 1977-78. In fact, we found so few courses in natural resources general and food science that a further refinement within these categories was not undertaken and these areas were not included in additional analyses.

In addition to an overall view of curriculum we examined differences that existed by region, control, and size. Table 3 represents the agriculture and natural resources curriculum that is actually scheduled, broken down by these three variables.

The most striking feature of the regional breakdown is the strong relationship between locale and offerings. While none of the colleges in the Northeast and only a few in the Middle States offer courses in agriculture and/or natural resources, the probability of a college offering them steadily increases as one moves west. This is most dramatically evident in the areas of forestry and wildlife-fisheries. However, it must be pointed out that the fact that colleges in the West offer courses in all categories may be a function of college size since 52 percent of the large institutions are in the West.

The variable of control (public or private) is not only influenced by college size but by emphasis. Of the private colleges, 89 percent are in the small category and 43 percent have a liberal arts orientation. These factors individually and, especially, in consort would severely limit the number of private colleges whose curriculums would include such courses.

Table 2

Agriculture and Natural Resources in the Two-Year Colleges, 1977-78 Academic Year

Type of Course	Percent of Colleges Listing This Type Course in Catalog (n=175)	Percent of Colleges Listing This Type Course in Class Schedule (n=175)	Percent of Total Ag. & Nat. Res. Courses Listed on Schedule (n=976)	Percent of Total Ag. & Nat. Res. Sections Listed on Schedule	
				Lecture (n=1459)	Laboratory (n=955)
Agriculture-General	33	27	9	8	6
Animal Science	39	31	21	21	19
Plant Science	46	39	35	35	41
Soil Science	50	40	14	14	17
Natural Resources-General	24	16	3	6	2
Forestry	17	13	8	8	8
Wildlife & Wildlands	21	14	7	6	4
Food Science	13	10	3	3	3

Note 1. 118 colleges (67% of sample) list one or more agriculture and natural resources courses in the college catalog.

Table 3

Course Offerings by College Region, Control, and Size (in Percent)

Group	Total Sample	Region						Control		Size		
		North-east	Middle States	South	Mid-West	Mt. Plains	West	Public	Private	Small 1-1499	Med. 1500-7499	Large 7500+
N	(175)	(11)	(21)	(54)	(39)	(22)	(28)	(147)	(28)	(10)	(78)	(25)
Agriculture-General	27	0	10	15	33	32	57	31	0	13	30	56
Animal Science	31	0	10	24	36	55	46	35	11	29	32	32
Plant Science	39	0	14	32	39	50	75	44	11	29	37	68
Soil Science	40	0	24	30	49	41	75	48	0	21	55	68
Forestry	13	0	5	7	8	5	50	15	4	8	13	28
Wildlife/ Fisheries	14	0	0	7	10	9	54	17	0	8	13	36

Size of college naturally influences the variety of courses offered. The most evident differences are the higher availability in large colleges of courses in agriculture-general, plant science, forestry, and wildlife-fisheries. The finding that these courses are usually found in large colleges is related to a sufficient student pool, a larger teaching staff, and adequate facilities and resources to accommodate more diversified offerings. In addition, the facts that large institutions are also public colleges and that the majority of large schools are in the West certainly influence the pattern of offerings.

College catalogs were used to determine instructional mode for each of the classifications (see Table 4).

Table 4

Percent of Courses in Each Category by Instructional Mode

	Lec Only	Lec-Lab	Lec-Lab-Field	Other
Agriculture-General	52	40	5	3
Animal Science	51	47		2
Plant Science	25	63	9	3
Soil Science	35	56	4	4
Natural Resources-General	77	7		16
Forestry	40	42	8	9
Wildlife & Wildlands	45	39	12	3
Food Science	22	78		

Classes designated as lecture only were those that did not have a separate but required laboratory. However, lab experiments and/or demonstrations may be incorporated into the class time within lecture courses. Lecture-lab classes were those that required a set number of laboratory hours in addition to the lecture hours. Lecture-lab-field courses were those that used field trips or field work in preparation for or in

cooperation with the lab work. The category "other" referred to courses that were offered by means of closed circuit TV on campus, those that were offered via open TV channels, and those that utilized individualized instruction.

Except for the Natural Resources-General category, the lecture course does not dominate. Rather, the lecture-lab format is heavily relied on to provide an opportunity to apply the subject matter learned in the classroom to a practical situation. The need to utilize a "hands-on" approach to learning and to incorporate situations that require knowing the "how" and "why" of what is being learned is a cardinal principle among writers and educators in the field. Our data clearly show that this principle has been absorbed into curricular and instructional practice.

Our analysis of units assigned to those lecture-lab and lecture-lab-field classes, and the division of hours between the lecture portion and the lab revealed considerable variation. Three- and four-unit courses were the most common, followed by two units and then five. One of the recommendations that emerged from the 1967-68 regional seminars on agricultural education (Sidney, 1968) was that the lab work should be equal to or greater than the class theory hours. Our findings show that generally such a division is used. In three-unit courses the prevailing arrangements were two hours of lecture and two or three hours of lab. In four-unit courses the most common divisions were three hours of lecture, two of lab, followed by three hours of lecture and three of lab. While a number of other patterns were also observed, most of them adhere to the concept that the time in the lab should be at least equal to, if not greater than, the time spent in lecture.

Prerequisites

One of the best indicators of the linearity of curriculum is the use of prerequisites as entry-level blocks on course enrollments. While there is concern among educators over course sequence and linearity, this concern is primarily directed to four-year programs (Commission on Education in Agriculture and Natural Resources, 1967a, b; Hamilton, 1968; Thompson, 1974). Our search revealed almost no discussion on this topic

specifically directed at two-year colleges.

Our findings in Table 5 show that the majority of courses do not have prerequisites.

Table 5

Prerequisites

	Number of Courses Actually Scheduled	Percent with Prerequisites
Agriculture-General	88	20
Animal Science	205	20
Plant Science	342	25
Soil Science	137	35
Forestry	78	44
Wildlife & Wildlands	68	41

In addition, no clear pattern emerged when we examined the type of prerequisite needed within each of the above categories. Within general agriculture prerequisites were needed more often for classes in pests and their control than for the other two groups. The most common prerequisite was an introductory course although some classes required biology, botany, or introductory horticulture. Although in animal science certain courses in all the subcategories had prerequisites, they were required more frequently in animal nutrition, animal health, and animal husbandry classes. Again, the most common was an introductory course, but in animal nutrition chemistry was required as frequently. In animal health and animal husbandry instructor's permission was the next most frequent followed by animal anatomy for the former and animal production for the latter.

Plant science also had some courses in all categories that had a prerequisite, but they were needed most in agronomy, horticulture, ornamental horticulture and greenhouse. The most common was an introductory course or part of a series. Plant-shrub-tree identification also served as prerequisites for greenhouse and ornamental horticulture as did botany

for the latter. Each category within soil science had one prerequisite that was required more than any other, but for each category it differed. For soil science it was chemistry; for irrigation it was an introductory course in fertilization followed by chemistry; and in soil mechanics it was static mechanics followed by an introductory course and then math. Although more courses in forestry required a prerequisite than in all the other categories, the requirements varied enormously. Nowhere was the lack of a consistent course pattern or sequence more apparent. Prerequisites included an introductory course on forest conservation, second-year standing, measurement, surveying, and math. In wildlife courses the most common prerequisite was ecology or an introductory conservation course, but in the other categories within this group again the requirements varied enormously.

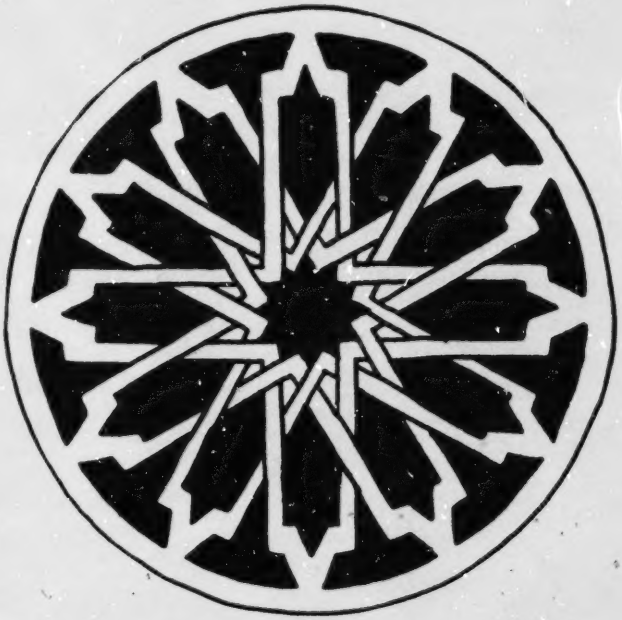
Our analysis of course sequencing reveals that in agriculture and natural resource classes the use of prerequisites is both limited and highly individualistic. Those institutions that have them seem to impose their own, and consequently there is neither a clear nor consistent curriculum pattern. The only indication of structure to emerge is that within the different categories an introductory or more elementary course is the most frequent prerequisite.

Summary

Agriculture and natural resource courses are listed and actually scheduled in 60 percent of the community colleges. More colleges offer soil science courses followed by plant science, animal science, and agriculture-general. However, the most prevalent offerings within these categories are in plant science, followed by animal science and then soil science. So few courses were scheduled in natural resources general food science that they were not included in most of this discussion.

There is a very distinctive regional pattern to offerings in these disciplines. While they are not offered in colleges in the Northeast and only infrequently offered in colleges in the Middle States, the probability of a college offering them steadily increases as one moves

west. Not surprisingly, courses in these fields are primarily found in the larger public institutions. Many courses utilize a lecture-lab format. While there is considerable variation in the division of hours between the lecture-lab portions for courses with equivalent units, the lab hours are generally equal to or greater than the hours spent in lecture. The use of prerequisites within the categories is both limited and highly individualistic.



PART II
INSTRUCTION

Two separate but related concerns dominate the literature on instruction. The primary concern revolves about the instructional methods and practices that best effectuate the transfer of classroom learning to nonacademic occupational surroundings. Interacting with this is a secondary concern--how to maximize student learning in classes with an increasingly diverse student population, not only in terms of ability but in terms of background and experiences. These concerns are translated in the literature on instruction into two major areas. The first continues the long-standing emphasis on learning by doing and blending the theoretical with the applied through the use of work experience, field trips, labs and other "hands-on" approaches. The second area encompasses the

studies and reports on individualizing instruction through audio-tutorial programs, computer-based educational systems, mastery learning, and others.

METHOD

The first step in assessing instructional practices in the sciences was to establish a random sample of colleges. The procedures used in putting this sample (N=175) together is described in the first section on curriculum. Briefly, each college president who agreed to participate in the study was asked to name a contact person at the school, who was given the title "on-campus facilitator." All communication and correspondence between the Center for the Study of Community Colleges and the sample colleges was conducted through the 175 on-campus facilitators.

Once the college catalogs were obtained from each school, the Center staff read each course description in the catalog and put courses in the appropriate category according to the course classification system that had been developed (see Part I). The next step involved counting the science course offerings in the Fall, 1977, day and evening schedules of classes. A list was developed for each college that showed the courses offered and the number of sections of the course that were listed in the schedule of classes.

The selection of individual class sections was done by drawing every thirteenth section in each of the six major science areas. After randomly selecting the first college, the system was automatically self-randomizing.

Using this procedure, every thirteenth section was pulled off the schedule of classes and recorded on a checklist for the facilitator at each school. This checklist included the name of the instructor listed as teaching the section, the course title, section number, and the days and time the class met. A copy of this checklist was kept at the Center to tally the surveys as they were received.

A survey form (see Appendix C for survey) for each instructor was mailed to the campus facilitator, together with instructions for

completing the questionnaire and a return envelope addressed to the same facilitator. The return envelope had the instructor's name listed as the return address and was clearly marked "Confidential." This enabled the on-campus facilitator to keep an exact record of who had responded without opening the envelope. This technique guarantees confidentiality to the respondent while also enabling the facilitator to follow up on the retrieval of surveys from nonrespondents.

Questionnaires were mailed between February 20 and April 10, 1978, to 1,683 instructors. Since this was after the completion of the fall term, 114 surveys were not deliverable due to faculty dismissal, retirement, death, etc. An additional 77 sections were cancelled. Of the 1,492 deliverable surveys, 1,275 were returned. This established an overall response rate of 85.5 percent. Questionnaires were retrieved from 100 percent of the faculty sampled at nearly 69 percent of the colleges. Table 6 shows the relationship between completed surveys in the different disciplines and the percent of the total number of science class sections offered in these disciplines in the 1977-78 academic year.

Of the 1,275 questionnaires returned, 38 were retrieved from instructors of agriculture and natural resources. The results reported here are based upon these responses and, as Table 6 indicates, the percentage that this number represents equals the percentage of agriculture and natural resource sections among the total science sections considered in our study. Thus while the actual number of agriculture and natural resource instructors sampled is small, the match between responses and total sections increases the level of confidence in our data.

RESULTS

Since instructional practices cannot be separated from either instructors or students, this section will begin with the data compiled from the survey on these two groups.

What do the faculty members look like? Our research reveals a generalized profile of agriculture and natural resource instructors and also delineates some distinctive characteristics. They tend to be

Table 6

Percent of Survey Responses and

Total Sections by Discipline

Discipline	Returns on the Instruction Survey--% of Total (n=1,275)	77-78 Academic Year --% of Total Lecture Sections (n=49,275)
Agriculture	3.0	3.0
Biology	12.5	10.5
Engineering	11.3	11.0
Math/Computer Science	30.8	32.5
Chemistry	6.4	5.1
Earth/Space	3.6	3.6
Physics	3.5	3.2
Interdisciplinary Natural Science	2.3	2.7
Anthropology and Interdisciplinary Social Science	2.4	3.0
Psychology	11.2	11.6
Sociology	7.4	8.1
Economics	5.4	5.6

experienced, having taught three to ten years, and their highest degree tends to be the master's. However, within this broad outline some interesting variations in teaching experience and academic training emerge.

Only 13 percent have taught more than 10 years, the lowest percentage of all the disciplines surveyed. At the other end of the experience spectrum more of these instructors have taught less than three years than any other group surveyed (24%). The phenomenal growth in one- and two-year programs in agriculture and natural resources would seem to account for this atypical experience range.

Several studies document the rate and extent of this growth. Becker and Noland (1968) compared the results of their 1967 survey with one that had been conducted four years earlier (Snepp, 1963). They found that while the percentage of students enrolled in the various programs (transfer, technical, vocational/adult) had changed only slightly, there had been an increase of 64 percent in the number of students enrolled in agriculture per institution. In collecting data for the 1975 Directory of Post-Secondary Education in Agriculture, Agribusiness, Natural Resources and Environmental Occupations, Erpelding (1976) was able to look at the growth trends since 1967. The number of institutions offering programs in agriculture and natural resources had increased threefold; student enrollment was five times greater, and the number of faculty teaching in these programs had grown by 675 percent. Furthermore, these increases seemed to anticipate growth in the years ahead.

Except for the engineering faculty, this group of instructors has the largest number whose highest degree is the bachelor's (21%). This finding is congruent with the practice reported by Sherman (1968) and Sypolt (1976) of two-year college instructors of agriculture moving up from the ranks of high school vocational-agriculture teachers. It may also contribute to the question discussed in the literature as to what constitutes adequate teacher preparation and to the need argued by Cragun (1970) and Halterman (1970), among others, to work toward the acceptance of the master's degree as the minimum standard of preparation.

From the sections surveyed the employment status of the agriculture and natural resource instructors compared to instructors in the total science sections surveyed was as follows:

Table 7
College Status of Agriculture/Natural Resource Faculty Compared to Total Faculty (in Percent)

	Agriculture/Natural Resource	Total
Full-time Faculty	73.7	78.7
Part-time Faculty	13.2	16.0
Department or Division Chairperson	21.1	7.2
Administrator	5.3	1.2

That such a high percentage of sections were taught by department or division chairpersons probably reflects the instructional organization of most two-year colleges in which agriculture is, if not a separate division, certainly designated as a separate department with its own chairperson.

Students

While the average initial class enrollment in all the science disciplines surveyed was 32, agriculture and natural resource course sections averaged 26 students. In an earlier NSF study of two-year college science faculty (1969) the median class size in agriculture was 18. The fact that our study revealed larger class enrollments is another indication of growth in these subject fields. These courses continue to attract primarily male students who outnumber the females by a ratio of three to one. However, the fact that females constitute almost a third of the class enrollments reinforces the trend cited in the literature (Anderson & Elkins, 1978; Kuznik, 1975; Vorst & Mullen, 1977) of the increasingly heterogeneous student population now found in agriculture

courses. The completion rate for these courses is a very high 90 percent compared to a 79 percent rate for all the disciplines surveyed (Table 8 indicates the completion rates for the various science disciplines).

Table 8

Completion Rates for Disciplines

Agriculture and Natural Resources	90%
Physics	87%
Sociology	83%
Psychology	82%
Engineering and Integrated Science	81%
Economics, Biology and Anthropology	81%
Chemistry	79%
Earth/Space	76%
Math	72%

Several interrelated factors are at work, and these may help to explain this high completion rate. First, many of these courses are requirements within various programs--transfer or two-year technical or certificate--and thus, an incentive is built in to complete them. Second, in the vocational-technical curricula, this incentive is strengthened by the emphasis on the relevance of course work to employment and job placement upon program completion (Elson, 1970; Stenzel & Lukens, 1972; Woods, 1977). A third factor may be related to student advisement. If, as the literature suggests (Dwyer, 1978; Elson, 1970; Jenkinson, 1978; Schein, 1967), agriculture faculty are involved with students in a counseling as well as an instructional role, this additional interaction should serve as a positive element in student retention. A fourth factor may be the ability of instructors to target their courses to a cross-section of students and meet their different needs and objectives. When queried as to how to describe the course in terms of the students

for whom it is intended, 71 percent reported that it parallels a lower division transfer course; 55 percent said it exists for transfer students majoring in one of the natural resource fields; 61 percent describe it as being for occupational students in science technology; and 41 percent cite adults seeking further education.

Course Goals and Instructional Activities

The instructional practices used by teachers will to some extent be determined by the course goals and objectives that they hold. In order to ascertain goals and objectives, we asked instructors to select one quality from three sets of four that they most wanted their students to achieve. The results (shown in Table 9) indicate a decided emphasis toward the practical and applied. This emphasis is certainly consonant with the literature which has as one of its major themes the necessity of providing students with the technical competencies to obtain at least entry level positions in the various specialized agricultural fields (Claridge, 1971; Eldridge, 1968; Hudson, 1976; Manley, 1968; Woods, 1977).

How does this emphasis on the practical and applied translate into the actual use of class time? Table 10 lists the percentage allotment of class time in agriculture/natural resource classes as compared to the allotment in all the science courses. The greatest cleavage between agriculture and natural resource classes and science classes in general is in the amount of class time spent on field trips. This finding serves to support the views presented in the literature on the importance field trips have in instruction in such classes (Anderson, 1972; Montario, 1977; Munday & Tinga, 1978).

Aside from the allotment of class time, we also looked at the percentage of faculty utilizing these different class activities. As expected, virtually all instructors lecture, and nearly all use quizzes and exams. Guest lectures are used in 26 percent of the agriculture classes, compared to only 12 percent of the total sample. Agriculture and natural resource instructors are also distinguished from their colleagues in the other science fields by the number who use laboratory practical examinations and quizzes, 37 percent compared to 18 percent of the total, and

Table 9

Desired Qualities for Students

	Agriculture
1) Understand/appreciate interrelationships of science and technology with society	23.7%
2) Be able to understand scientific research literature	--
3) Apply principles learned in course to solve qualitative and/or quantitative problems	57.9
4) Develop proficiency in laboratory methods and techniques of the discipline	13.2
1) Relate knowledge acquired in class to real world systems and problems	31.6
2) Understand the principles, concepts, and terminology of the discipline	47.4
3) Develop appreciation/understanding of scientific method	--
4) Gain "hands-on" or field experience in applied practice	18.4
1) Learn to use tools of research in the sciences	21.1
2) Gain qualities of mind useful in further education	21.1
3) Understand self	2.6
4) Develop the ability to think critically	50.0

Table 10

Amount of Class Time Devoted to Activities

	Agriculture/Natural Resource Classes	Total Science Classes
Lecture	42%	45%
Class Discussion	11	15
Field Trips	10	*
Lab Experiments by Students	9	11
Quizzes/Exams	6	10
Lecture/Demonstration Experiments	6	3
Viewing and/or Listening to Film or Taped Media	5	4
Student Verbal Presentations	3	3
Laboratory Practical Exams	2	2
Guest Lectures	1	*
Simulation/Gaming	*	*
Other	2	5

*Indicates less than one percent.

even more by the number who used field trips--58 percent compared to 10 percent of the total. Interestingly, a large number (60% compared to 46% of the total) use media. Thus, while these courses are in general taught much like other science courses, the differences that do exist are all in the direction of actively involving students in learning and providing them with a wider exposure to the actual problems, practices, and situations that they are likely to encounter in occupations in these fields.

Instructors were asked not only if they used media and instructional aids but also the type and frequency. Table 11 shows the use of instructional media and aids among agriculture and natural resource instructors and compares their usage to all science instructors surveyed. Agriculture and natural resource instructors are most distinctive in the frequency of their use of slides, overhead transparencies and natural preserved or living specimens. They are most like their colleagues in the other disciplines in their tendency to eschew such technological approaches as closed-circuit TV, videotapes, and audiotapes/cassettes.

Grading and Exams

Instructors were asked to what extent various classroom activities are used to determine students' grades. Only two activities played an important part in determining the grade; these were quick-score objective tests, used by 61 percent of the instructors, and essay exams, used by 40 percent. Between a quarter and one-half of the instructors said that field reports, papers written outside of class, homework, participation in class discussions, and problem sets were included in evaluation but that they counted less than 25 percent. In light of the literature's emphasis on applying the course content to actual situations, it was surprising to note that over 50 percent of the respondents did not include papers written in class, oral work, workbooks, research reports, nonwritten projects, practical exams, and problem sets in determining the grade.

The most commonly used type of test question is multiple response, which is "frequently" utilized by 68 percent of the agriculture and

Table 11

Use of Instructional Media and Aids (in Percent)

	Frequently		Occasionally	
	Agriculture Instructors	Total	Agriculture Instructors	Total
Films	3	9	68	40
Single concept film loops	3	1	26	13
Filmstrips	11	3	29	16
Slides	40	8	37	22
Audiotape/slide/film combinations	3	3	18	16
Overhead projected transparencies	40	20	26	27
Audiotapes, cassettes, records	0	3	11	17
Videotapes	3	3	24	17
Television (broadcast/closed circuit)	3	1	8	8
Maps, charts, illustrations, displays	24	20	53	36
Three dimensional models	3	10	42	27
Scientific instruments	13	18	45	21
Natural preserved or living specimens	37	9	24	7
Lecture or demonstration experiments involving chemical reagents or physical apparatus	5	10	45	17

natural resource instructors. Completion and essay questions were the next most popular forms of test questions. Each was used "frequently" by 53 percent and "never used" by 18 percent. Considering that in the total sample only 25 percent frequently used completion questions and 31 percent used essay exams, the number of agriculture instructors using these forms is high.

Since tests played such a large role in determining students' grades, it is extremely important to look at the abilities that instructors want their students to demonstrate on exams and quizzes. Table 12 presents the responses to this question for agriculture and natural resource instructors and for the total sample:

Table 12

Desired Student Abilities (in Percent)

	Agriculture Instructors	Total
Mastery of a Skill		
Very Important	47	51
Not Important	21	17
Acquaintance with Concepts of Discipline		
Very Important	84	83
Not Important	3	1
Recall of Specific Information		
Very Important	50	43
Not Important	3	6
Understand the Significance of Certain Works		
Very Important	53	45
Not Important	13	17
Ability to Synthesize Course Content		
Very Important	45	47
Not Important	10	10
Relationship of Concepts to Student's Own Values		
Very Important	42	24
Not Important	16	36

Like their counterparts in the other science disciplines, instructors in agriculture and natural resources use as their primary criterion for quizzes and exams the extent to which students can demonstrate an acquaintance with the concepts in the disciplines. The other abilities are considered "very important" by about half of the respondents in each group. The most striking difference between agriculture and natural resource instructors and the total group is in the importance they attribute to "Relationship of concepts to student's own values." In considering this ability so highly, agriculture and natural resource instructors are much closer to their colleagues in the social science disciplines than they are to instructors in the other science disciplines.

Placing such a value on this ability seems at first to contradict the course goals held by instructors (see Table 9). There the goal "Understand Self" was given a very low priority in relation to the more practical occupationally related goals. But such an emphasis is quite consistent with the literature which stresses relating the subject matter to the student's actual world, joining classroom material to the student's career goals, and analyzing the abilities and needs of the student in relation to both the curriculum and its career opportunities (Claridge, 1971; Elson, 1970; Munday & Tinga, 1978; Schein, 1967).

Instructional Materials

The choice of reading materials, amount of reading required, and the level of faculty satisfaction with the materials used are all important topics to be explored when considering instructional practices. As expected, the most widely used reading material was the textbook, which was utilized by 87 percent of the instructors; this was followed very closely by syllabi and handout material (84%). The average instructor assigned 257 pages of textbook reading--a figure somewhat low in relation to the total sample but close to such disciplines as physics, earth/space, and engineering. Two-thirds of the instructors were "well satisfied" with the texts, and 88 percent of them had total say in textbook selection. The latter was the highest percentage for any discipline surveyed

and, compared to 42 percent for the complete sample, indicates a high degree of autonomy for these instructors.

Slightly over half of the instructors use journal and magazine articles and slightly under half use laboratory materials and workbooks. Again, nearly all the instructors have total say in these materials and while satisfaction is high with the journals and magazines, only 47 percent felt well satisfied with the lab materials and workbooks. The least used reading materials are newspapers and collections of readings.

Out-of-Class Instructional Activities

Instructors were also asked to note which, if any, out-of-class activities were required or recommended. The list of activities included on-campus educational films, other films, field trips, television programs, attendance at museums/exhibits, outside lectures, and volunteer service on community projects. Whereas less than five percent of the total sample required any of the above, a quarter of the agriculture and natural resource instructors required field trips and a fifth required attendance at exhibits. In addition, a high percentage recommended the aforementioned activities as well as recommending volunteer service on an environmental project. This interest in expanding the learning experience beyond the confines of the classroom meshes with the overriding concern that the curriculum should prepare students for at least entry level jobs in the field. Furthermore, it underscores much of the literature that takes the position that only by extending the learning experience to out-of-class situations will it be meaningful.

Course Improvement

In addition to determining how instructors teach their courses, we wanted to know what the instructors felt they needed to make their course even more effective. Table 13 lists the responses and compares them to the total sample:

Table 13

Factors Desired by Faculty to Increase Course Effectiveness

	Agriculture Instructors	Total
More freedom to choose materials	3%	9%
More interaction with colleagues or administrators	21	19
Less interference from colleagues or administrators	5	4
Larger class (more students)	16	8
Smaller class	24	29
More reader/paraprofessional aides	11	13
More clerical assistance	16	17
Availability of more media or instructional materials	58	36
Stricter prerequisites for admission to class	13	31
Changed course description	8	6
Instructor release time to develop course and/or material	63	38
Different goals and objectives	5	4
Professional development opportunities for instructors	21	25
Better laboratory facilities	26	21
Students better prepared to handle course requirements	34	53

The desire for more release time is not unique to instructors in agriculture and natural resources; in fact, this desire is continually voiced among members of the teaching profession at all levels. Whether this desire will be realized--even with the move towards unionization--seems very questionable, given the financial pressures that exist on educational institutions at this time. However, what needs to be recognized in this monograph is that a higher percentage of agriculture and

natural resource instructors checked this item than any other group and accordingly, it seems important to explore possible causes.

Although frequently a desire for release time goes hand in hand with feelings that classes are too large and/or students in them are inadequately prepared, such a connection is not obvious here. True, average class size has increased from 18 in 1966-67 (NSF, 1969) to 26 reported in our study. But only 11 percent of the instructors felt a smaller class would be beneficial, whereas a quarter of them felt that larger classes would enhance effectiveness. These respondents certainly share in the almost universal concern for student preparation, but, again, fewer of them see this as an obstacle to an effective course than any other group surveyed.

Rather, the desire for release time may spring from the instructors' needs for more media and instructional material, as indicated both by the high percentage who checked this item and by their responses to other questions in our study. Whereas in 1967, 82 percent of the agriculture instructors were satisfied with their textbook (NSF, 1969), our findings showed that only 67 percent were. In the earlier study, eight percent did not use a textbook while our study revealed that 13 percent did not. Thus there may be a trend toward faculty dissatisfaction with textbooks, a dissatisfaction that may result from a combination of factors. First, there is the nationwide decline in student reading scores; the impact of this is very strong at the two-year college level and may in effect make many of the college texts unsuitable. Second, the available texts may presuppose certain background knowledge and experiences that are no longer valid, given today's heterogeneous student clientele. Third, the proliferation of new methods, techniques, and practices in the field may well make the older texts obsolete.

In addition, as noted earlier in this section, a large number of these instructors do use instructional media. From our data we cannot tell either the availability and the quality of various forms of media or the satisfaction of our responding instructors. We do, however, know that in institutions where there are media production facilities 80 percent of the instructors utilized them. The above findings certainly

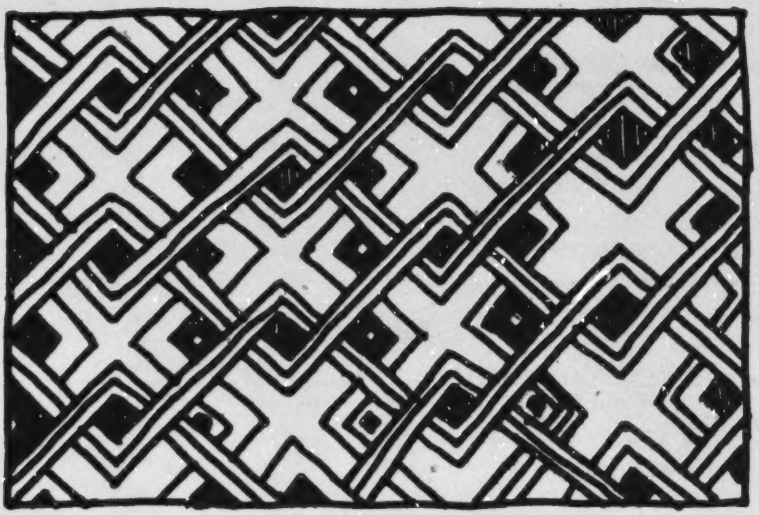
point to the conclusion that instructional materials in the field need improvement and instructors feel strongly that they need release time to develop new and better materials.

In Summary

Our findings indicate that many of the goals and methods of occupational education are translated into active practice by instructors of agriculture and natural resource courses. Classes are targeted for transfer and non-transfer students as well as for adults interested in furthering their education. Judging from the very high completion rate, instructors successfully meet the needs and educational objectives of this diverse student group. Part of their success may rest in the unique blending of course objectives to relate the course material to actual job connected situations and to the students' own values.

Instructors utilize activities both in and out of class that involve students in the material, that provide a first-hand exposure to practices in the disciplines, and that promote "hands-on" experiential learning. Grades are primarily determined by short answer and essay exams. Very little emphasis, at least in terms of grades, is given to other types of written assignments. Texts are the most widely used reading material followed closely by syllabi and hand outs, and there is some use of journal articles and lab materials. While instructors have almost complete freedom in choosing these materials, there is some dissatisfaction with them. Instructional media, particularly slides, overhead transparencies, and specimens are used frequently by instructors.

Most instructors have taught between three and ten years and their highest degree is the master's. To make their course more effective the majority feel they need release time to develop materials as well as a greater availability of media and instructional materials. Some would like students who are better prepared, better lab facilities, and smaller classes. On balance, however, our findings indicate that instructors in these disciplines enjoy a great deal of autonomy in their professional role, and are generally satisfied with their courses.



PART III
CONCLUSIONS

This monograph presents an overall picture of curriculum and instructional practices in agriculture and natural resources in two-year colleges. The purpose of this study was to examine the scientific content in agriculture education at the course level. Other studies have focused on programs. Consequently, there were inherent problems in discussing our data with past studies.

Despite this difficulty, two major facts emerge from the literature that need to be reiterated here. The first is that agriculture and natural resource programs, and consequently the courses within them, have experienced enormous growth in the past fifteen years. The second is that this growth means that educational consumers find these programs meaningful and

useful in accomplishing occupational and educational objectives. Our findings in no way gainsay the above. Rather using our data as the source of discussion, the remarks that follow suggest areas to which we feel those involved with agriculture education may want to turn.

The finding that the use of prerequisites is limited and that when they are required there is no pattern or sequence is surprising. Since the courses included in our examination emphasize scientific fact and theory, it seems reasonable that more of them would be built on principles learned from prerequisite courses in the biological sciences, in chemistry, and in math. The need for a solid foundation in the basic sciences was strongly emphasized by the Commission on Education in Agriculture and Natural Resources (1967) in looking at four-year programs. But students in two-year programs will also be involved in tackling the complex problems of agriculture in the future--either at the technological or scientific level. In order to do so they, too, need a foundation in scientific principles and concepts. Therefore, one of our recommendations is that program planners may want to evaluate the basic science component within the various curricula and institute a course sequence that uses key science and math courses as building blocks for the more specialized agriculture courses.

Within the literature there is a strong consensus that one of the aims of agriculture and natural resource curriculum is to develop the ability of students to think, speak, and write effectively. These communication skills are deemed as important for successful employment as are the proficiencies in the various technical specializations. To accomplish this, most programs include general education courses. However, the importance of written and verbal expression and activities that encourage skill development need to be incorporated into the agriculture and natural resource courses themselves. Our findings indicate that activities utilizing such skills are not included in determining the grade or are accorded minimal importance. We feel that instructors should assess both the frequency with which they use such assignments and the importance they attach to them in order to encourage the development of these skills in their students.

Our findings show that a majority of these instructors use instructional media in their classes. However, their use of media seems fairly conventional since they primarily rely on slides, films, and overhead transparencies. Only infrequently do they employ audiotapes, cassettes, and closed circuit TV. In addition, in examining modes of instruction, we found very few courses that utilized individualized instruction or a TV format. Thus it seems that the use of audio-tutorial programs and computer based systems to individualize instruction is not widespread and the reports in the literature of their use are isolated experiments.

A more innovative use of media is an area that those involved with agriculture education at all levels may want to encourage. Media is currently used chiefly to illustrate material. But the many advances in instructional technology have the potential, largely untapped, to effect greater change in both teaching and learning. Instructional technology can allow for more flexibility and variety in subject presentation, provide more opportunity for independent study, and assist in self-pacing for both the rapid and slow learner.

Our data do not permit us to hazard a guess as to whether, in this period of financial belt tightening, the need expressed by instructors for release time will be realized. However, we can with certainty say that instructors of agriculture and natural resources are faced with an increasingly diverse group of students and are in fields where practices and technologies are constantly changing. These two facts accentuate their need to continually up-date their course and its materials.

We have briefly outlined above some of the exciting uses of instructional technology. Textbooks and other reading materials are also in need of attention. But to develop either or both of these materials requires time and resources. If release time is not forthcoming for instructors to work on these, we recommend that program planners, professional organizations, and instructional specialists at the state and national level direct their energy and resources to the development of course materials.

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*A number in parentheses, preceded by "ED," refers to an Educational Resources Information Center (ERIC) document available from the ERIC Document Reproduction Service, Box 190, Arlington, Virginia 22210, or viewed in any library that has the collection.

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APPENDIX A

Region I NORTHEAST

Connecticut

Greater Hartford
Mitchell
Quinebaug

Massachusetts

Bay Path
Bunker Hill
Mt. Wachusett

Maine

University of Maine/
Augusta

New Hampshire

New Hampshire Tech.
White Pines

New York

Cayuga County
Genesee
Hudson Valley
North Country

Vermont

Champlain
Vermont Col. of
Norwich U.

Region 2 MIDDLE STATES

Delaware

Delaware Tech. and C.C./
Terry Campus
Goldey Beacom

Maryland

Dundalk
Hagerstown
Harford
Howard
Villa Julie

New Jersey

Atlantic
Middlesex County

Pennsylvania

Allegheny County/Boyce Campus
Delaware County
Harcum
Keystone
Northampton County
Northeastern Christian

West Virginia

West Virginia Northern
Potomac State

Region 3 SOUTH

Alabama

James Faulkner State
John C. Calhoun State
Lurleen B. Wallace State
Northwest Alabama State

Arkansas

Central Baptist
Mississippi County
Westark

Florida

Brevard
Edison
Florida
Palm Beach
Seminole
Valencia

Georgia

Atlanta
Bainbridge
Clayton
Floyd
Georgia Military
Middle Georgia
South Georgia

Kentucky

Southeast

Mississippi

Itawamba
Mary Holmes
Mississippi Gulf Coast/
Jefferson Davis Campus
Pearl River
Southwest Mississippi
Wood

North Carolina

Chowan College
Coastal Carolina
Edgecombe Tech.
Halifax City Tech.
Lenoir
Richmond Tech.
Roanoke-Chowan Tech.
Wake Tech.

South Carolina

Greenville Tech.
University of South Carolina/
Lancaster

Tennessee

Jackson State
Martin
Morristown
Shelby State

Texas

Angelina
Lamar University/Orange Branch
San Antonio
Vernon Regional
Weatherford

Virginia

Central Virginia
Northern Va./Alexandria
New River
Southern Seminary
Tidewater
Thomas Nelson
Wytheville

Region 4 MIDWEST

Illinois

Central YMCA
Danville
Highland
Kishwaukee
Lincoln Land
Oakton
Waubonsee
William Rainey Harper

Iowa

Clinton
Hawkeye Institute of Tech.
Indian Hills
Iowa Lakes
Marshalltown
Southeastern

Michigan

Bay de Noc
Delta
Kalamazoo Valley
Kirtland
Monroe County
Oakland
Suomi

Minnesota

Austin
North Hennepin
Northland
University of Minnesota Tech.
Willmar

Missouri

St. Paul's
Three Rivers

Nebraska

Metropolitan Tech.
Platte Tech.

Ohio

Edison State
Loraine County
Northwest Tech.
Shawnee State
Sinclair
University of Toledo
Comm. and Tech.

Wisconsin

District One Tech.
Lakeshore Tech.
Milwaukee Area Tech.
University Center System/Sheboygan
Western Wisconsin Tech.

Region 5 MOUNTAIN PLAIN

Colorado

Arapahoe
Community College of Denver
Auraria Campus
Morgan
Northeastern

Kansas

Barton County
Central
Coffeyville
Hesston
St. John's

Montana

Miles

North Dakota

North Dakota St. Sch. of Science

Oklahoma

Connors State
Hillsdale Free Will Baptist
Northern Oklahoma
South Oklahoma City
St. Gregory's

South Dakota

Presentation

Utah

College of Eastern Utah
Utah Tech.

Wyoming

Central Wyoming

Region 6 WEST

Alaska

Ketchikan

Arizona

Cochise
Pima

California

American River
Butte
Citrus
College of San Mateo
College of the Desert
College of the Sequoias
Fresno City College
Hartnell
Lassen
Los Angeles Pierce
Mendocino
Merced

California (continued)

Mt. San Jacinto
Saddleback
San Bernardino Valley
San Diego Mesa
Santa Rosa

Nevada

Clark County

Oregon

Chemeketa
Mt. Hood
Umpqua

Washington

Green River
Lower Columbia
Peninsula
South Seattle

APPENDIX B

AGRICULTURE AND NATURAL RESOURCES AND RELATED TECHNOLOGIES

Includes courses and programs having to do with the development, care, production, and management of food, natural fiber, animal, plant, forest and wildlife resources. More detailed descriptions and analyses can be found in the further breakdown in each of the following classifications:

Agriculture-General
Animal Science
Plant Science
Soil Science
Natural Resources-General
Forestry
Wildlife and Wildlands
Food Science

AGRICULTURE-GENERAL

The courses included in this category are introductory general education courses to orient the general student to the scope of the agriculture industry as well as introductory core program courses for agriculture majors. The topics covered include agriculture principles, and industry, physiological and biological factors, pest control, and engineering principles for farm mechanization.

Introduction/Orientation
Pests and Their Control
Agriculture Engineering

INTRODUCTION/ORIENTATION

These courses explore concepts in modern agriculture and cover a wide range of topics--primarily, the interrelationships between plants, sods, animals, and how they apply to the agriculture industry. Courses are intended for all students and satisfy general education requirements.

PESTS AND THEIR CONTROL

These courses are designed to introduce the agriculture major to the identification and chemical control of principal plant pests and weeds. Entomology, pesticide formulation, application methods, proper selection and use and safety of herbicides and insecticides are covered.

AGRICULTURE ENGINEERING

These courses are an introduction to agricultural engineering and cover the topics of farm power, machinery, electrification, and farm structures. Courses are intended primarily for vocational students in agriculture technology programs. Construction, materials, equipment maintenance and operation are excluded.

ANIMAL SCIENCE

This category includes courses that survey principles of production, management, and marketing of livestock as well as an introduction to goals and objectives of an animal science program. The category breaks down further to include courses dealing with specialized topics of animal production--primarily breeding, nutrition, health and husbandry. The animal science courses are designed for students intending to complete programs in farm management and other animal industry-related technologies. Courses dealing specifically with equipment, animal maintenance and care are excluded.

Animal Science
Animal Breeding
Animal Nutrition
Animal Health
Animal Husbandry

ANIMAL SCIENCE

This topic is comprised of courses that are generally a program orientation and introduction to the industry for farm management students. Specifically, the courses cover characteristics of major livestock breeds, breeding practices, nutrition, management, and marketing. In most cases these courses are prerequisites for more advanced and specific issues covered in the following sub-categories.

ANIMAL BREEDING

These courses discuss the theory and practice of artificial insemination of farm animals. The courses include physiology of reproduction, genetics, selection, crossbreeding, inbreeding, specimen collection, storage, and shipment. Most courses include practical field experience in artificial insemination techniques and in some cases fulfill requirements for certification. The courses are required for farm management and other animal industry related program completion.

ANIMAL NUTRITION

Included here are discussions of digestion, absorption, metabolism of nutrients as related to growth and reproduction of ruminant and monogastric animals, livestock nutrient requirements, feed composition,

feeding standards, and ration formulation. The course is a core program requirement for students majoring in farm management or other animal industry-related programs.

ANIMAL HEALTH

This topic includes treatment of health problems in the major livestock breeds associated with major physiological systems, interrelated metabolic disorders, and parasites. Fundamentals of immunity, disease symptomology, and examination are presented through a preventative health model. These courses are intended for students majoring in farm management or other animal industry-related programs.

ANIMAL HUSBANDRY

This category breaks down into general survey courses covering principles of livestock management, breeding, nutrition, and marketing, as well as more specialized courses applying these issues to cows, swine, sheep, poultry, horses, and dairy animals. These courses are intended for students in farm management and other animal industry-related programs.

PLANT SCIENCE

Plant science covers a wide range of crop and horticultural topics and emphasizes theory and technique through practical experience. The basic areas covered are plant production, field crops, horticultural practices, greenhouse management, and plant disease. In general, courses are intended for crop and horticultural science majors, but courses are also included for the general student. Courses in landscaping, floral design, equipment maintenance and operation are excluded.

Plant Science
Agronomy
Horticulture
Ornamental Horticulture
Greenhouse
Plant Pathology

PLANT SCIENCE

These courses are basic plant science courses intended to introduce students to the fields of crop and horticultural science. They cover the topics of plant identification, weeds, seeds, basic terminology, physiology, and plant propagation techniques. Most courses are required for completion of crop and horticultural science programs and prerequisites for the more specialized sub-categories that follow.

AGRONOMY

Courses in this category examine representative field crops and related economic/environmental factors. Special emphasis is given to cereal, grain, and forage crops. Topics focus on growth, disease, harvesting practices, fertilization, storage, and land management and renovation. These courses are designed to fulfill crop and horticultural science program requirements.

HORTICULTURE-VEGETABLE AND FRUIT CROPS

Included here are courses intended as non-major electives for all students and more specialized practical courses for horticultural science majors. Courses designed for non-majors focus on home vegetable gardening and an overview of horticultural science. Courses for horticultural science students focus on theory and appreciation of techniques in plant propagation, soil treatments, fertilization, and identification as they relate to commercial production of major fruit and vegetable crops.

ORNAMENTAL HORTICULTURE

These courses introduce horticulture students to nursery practices, production, care and maintenance of ornamental plants. Flowers, trees, shrubs, turf grass are studied in terms of structure, growth, water, soil, light, temperature, pruning, disease, and pests.

GREENHOUSE MANAGEMENT

Types of plants grown in the greenhouse and how growth is accomplished under glass are major concepts covered in these courses. Management, light, heat, humidity and potting, transplanting, and fertilizing are considered. These courses vary in depth and can be taken by horticultural science majors or as an elective by non-majors.

PLANT PATHOLOGY

These courses introduce the crop and horticultural science students to common plant diseases caused by virus, fungi, and environmental factors. The courses emphasize identification, cause, and control.

SOIL SCIENCE

Soil science courses appear as program requirements in the areas of agriculture, engineering, forestry and horticulture. The three classifications focus on primary issues of soil science, irrigation/fertilization and soil mechanics. Soil science surveys chemical, physical, and biological properties of soils. Advanced treatment of maintenance and management techniques is covered in irrigation/fertilization and in soil mechanics.

Soil Science
Irrigation/Fertilization
Soil Mechanics

SOIL SCIENCE

Soil science courses introduce students to basic chemical, biological, and physical properties of soil. These courses are designed to cover soil topics related to the fields of agriculture, engineering, forestry including soil as life support medium for plants, conservation, management, strength and bearing capacity. The major topics of soil science are covered in greater depth in the following two courses.

IRRIGATION AND FERTILIZATION

Principles of irrigation, application methods and systems, drainage, and plant requirements are considered with relationship to soil fertility. Additional topics covered are chemical nutrition, types of fertilizers, determination of nutrient functions, deficiency and toxic symptoms of nutrients. These courses are intended for agronomy, forestry, and engineering students.

SOIL MECHANICS

These courses appear in agriculture, construction engineering and forestry technology programs. Central focus is on types and classification of soils, as well as laboratory/field testing and sampling techniques.

NATURAL RESOURCES

These courses are intended for all students as an introduction to the history of environmental conservation in the United States. Conservation is studied in the areas of soil, water, wild life, forests, ranges, and atmosphere. Implementation through government programs is also studied with an emphasis on the future of U.S. natural resources.

FORESTRY

The courses in this classification cover the major aspects of forest technology. Introductory courses survey the industry and orient students to the forestry program. Forest sciences, technology methods, and forest products are dealt with in each of the sub-categories. Topics not included in this classification are fire fighting, equipment used in forestry and related technologies, and recreation principles.

Introduction
Forest Sciences
Forest Technology
Forest Products

INTRODUCTION TO FORESTRY

Courses in this category are an orientation to forestry in the United States. They introduce forestry students to skills and products related to the industry. This course is often a prerequisite for more advanced topics dealt with in the following three courses.

FOREST SCIENCES

These courses cover silvics, silviculture, dendrology, reforestation methods, and ecological concepts. They are designed for forestry, recreation, and fire science students.

FOREST TECHNOLOGY

These courses cover a wide range of techniques used in forest technology. Included are forest navigation, tree measurement, forest inventory and forest preservation against fire, insects and disease. The courses are intended for advanced students in forestry, fire science, and recreation programs. Courses dealing with the topics of equipment, log scaling, timber harvesting, and fire fighting are excluded.

FOREST PRODUCTS

These courses discuss the marketing, management and manufacture of wood products, pulp and paper. Courses are intended for forest technology study.

WILDLIFE AND WILD LANDS

Courses in this classification are intended primarily for students in fire science, parks and recreation, forest, fishery, and environmental technology programs. Maintenance, management and techniques involved are discussed in relationship to fisheries, wildlife, wild land, range, and water. These courses do not include fire fighting techniques or recreation principles.

Fisheries
Wildlife
Range
Wild Land
Water

FISHERIES

All aspects of fishery technology are covered by courses in this category. Among major course topics are fish taxonomy, hatchery methods, history, disease symptomatology, treatment, and prevention. These courses are intended for fishery technology students.

WILDLIFE

Identification, management, population control of all game, birds, pests, predators, and waterfowl are primary topics covered by courses in this category. Current management practices and game regulations are included. Courses are intended for forest technology, parks and recreation, and fire science students.

RANGE

Management techniques of seeding fertilization, improvement water structure and pasture rotation are the primary topics covered in this category. These courses are intended for students in agriculture, forestry, parks and recreation and fire science programs.

WILD LAND

The courses in this category focus on wild land management for forestry and fire science students. Major topics include plant ecology, identification, environmental controls, field investigation, plant communities, and fire prevention. Courses on methods of fire fighting and recreation are excluded.

WATER

These courses discuss water resource development, hydrology, principles of water use, drainage, and erosion. These courses are intended for parks and recreation, and forestry students.

480-006

Center for the Study of Community Colleges

INSTRUCTOR SURVEY

Your college is participating in a nationwide study conducted by the Center for the Study of Community Colleges under a grant from the National Science Foundation. The study is concerned with the role of the sciences and technologies in two-year colleges — curriculum, instructional practices and course activities.

The survey asks questions about one of your classes offered last fall. The information gathered will help inform groups making policy affecting the sciences. All information gathered is treated as confidential and at no time will your answers be singled out. Our concern is with aggregate instructional practices as discerned in a national sample.

We recognize that the survey is time-consuming and we appreciate your efforts in completing it. Thank you very much.

1a. Your college's class schedule indicated that in Fall, 1977 you were teaching:

_____ (Course) 11-13 _____ (Section)

If this class was assigned to a different instructor, please return this survey to your campus facilitator to give to the person who taught this class.

If the class was not taught, please give us the reason why, and then return the uncompleted survey form in the accompanying envelope.

b. Class was not taught because: (explain briefly) _____

_____

_____

Please answer the questions in relation to the specified class.

2. Approximately how many students were initially enrolled in this class?

Males _____ 14-16

Females _____ 17-19

3. Approximately how many students completed this course and received grades? (Do not include withdrawals or incompletes.)

Males _____ 20-22

Females _____ 23-25

4. Check each of the items below that you believe properly describes this course:

a. Parallel or equivalent to a lower division college level course at transfer institutions . . . . . ☐ 1 — 26

b. Designed for transfer students majoring in one of the natural resources fields (e.g., agriculture, forestry) or an allied health field (e.g., nursing, dental hygiene, etc.) . . . . . ☐ 2

c. Designed for transfer students majoring in one of the physical or biological sciences, engineering, mathematics, or the health sciences (e.g., pre-medicine, pre-dentistry) . . . . . ☐ 3

d. Designed for transfer students majoring in a non-science area . . . ☐ 4

e. Designed for occupational students in an allied health area . . . . ☐ 5

f. Designed for occupational students in a science technology or engineering technology area . . . . . ☐ 6

g. Designed as a high school make up or remedial course . . . . . ☐ 7

h. Designed as a general education course for non-transfer and non-occupational students . . . . . ☐ 8

i. Designed for further education or personal upgrading of adult students . . . . . ☐ 9

j. Other *(please specify)*:_____ ☐ 0

5a. Instructors may desire many qualities for their students. Please select the one quality in the following list of four that you most wanted your students to achieve in the specified course.

1) Understand/appreciate interrelationships of science and technology with society . . . . . ☐ 1 — 27

2) Be able to understand scientific research literature . . . . . ☐ 2

3) Apply principles learned in course to solve qualitative and/or quantitative problems . . . . . ☐ 3

4) Develop proficiency in laboratory methods and techniques of the discipline . . . . . ☐ 4

b. Of the four qualities listed below, which one did you most want your students to achieve?

1) Relate knowledge acquired in class to real world systems and problems . . . . . ☐ 1 — 28

2) Understand the principles, concepts, and terminology of the discipline . ☐ 2

3) Develop appreciation/understanding of scientific method . . . . ☐ 3

4) Gain "hands-on" or field experience in applied practice . . . . . ☐ 4

c. And from this list, which one did you most want your students to achieve in the specified class.

1) Learn to use tools of research in the sciences . . . . . ☐ 1 — 29

2) Gain qualities of mind useful in further education . . . . . ☐ 2

3) Understand self . . . . . ☐ 3

4) Develop the ability to think critically . . . . . ☐ 4

6a. Were there prerequisite requirements for this course? Yes ☐ 1 No ☐ 2 — 30

b. IF YES: Which of the following were required? (CHECK AS MANY AS APPLY)

1) Prior course in the same discipline taken in high school ☐ 1 . . college ☐ 7 — 31

2) Prior course in any science taken in high school ☐ 2 . . college ☐ 8

3) Prior course in mathematics taken in high school ☐ 3 . . college ☐ 9

4) Declared science or technology major . . . . . ☐ 4

5) Achieved a specified score on entrance examination . ☐ 5

6) Other *(please specify)*:_____ ☐ 6

7. Over the entire term, what percentage of class time is devoted to each of the following:

a. Your own lectures	_____%	32/33
b. Guest lecturers	_____%	34/35
c. Student verbal presentations	_____%	36/37
d. Class discussion	_____%	38/39
e. Viewing and/or listening to film or taped media	_____%	40/41
f. Simulation/gaming	_____%	42/43
g. Quizzes/examinations	_____%	44/45
h. Field trips	_____%	46/47
i. Lecture/demonstration experiments	_____%	48/49
j. Laboratory experiments by students	_____%	50/51
k. Laboratory practical examinations and quizzes	_____%	52/53
l. Other *(please specify)*:_____		
_____	_____%	54/55

Please add percentages to make sure they agree with total TOTAL: 100 %

8. How frequently were each of the following instructional media used in this class?

Also check last box if you or any member of your faculty developed any of the designated media for this course.

	Frequently used	Occasionally used	Never used	Developed by self or other faculty member	
a. Films	☐1	☐2	☐3	☐4	56
b. Single concept film loops	☐1	☐2	☐3	☐4	57
c. Filmstrips	☐1	☐2	☐3	☐4	58
d. Slides	☐1	☐2	☐3	☐4	59
e. Audiotape/slide/film combinations	☐1	☐2	☐3	☐4	60
f. Overhead projected transparencies	☐1	☐2	☐3	☐4	61
g. Audiotapes, cassettes, records	☐1	☐2	☐3	☐4	62
h. Videotapes	☐1	☐2	☐3	☐4	63
i. Television (broadcast/closed circuit)	☐1	☐2	☐3	☐4	64
j. Maps, charts, illustrations, displays	☐1	☐2	☐3	☐4	65
k. Three dimensional models	☐1	☐2	☐3	☐4	66
l. Scientific instruments	☐1	☐2	☐3	☐4	67
m. Natural preserved or living specimens	☐1	☐2	☐3	☐4	68
n. Lecture or demonstration experiments involving chemical reagents or physical apparatus	☐1	☐2	☐3	☐4	69
o. Other *(please specify)*:_____	☐1	☐2	☐3	☐4	70

57

9. **Which of the following materials were used in this class? CHECK EACH TYPE USED. THEN, FOR EACH TYPE USED, PLEASE ANSWER ITEMS A-D.**

	A.	B.			C.		D.			
							How much say did you have in the selection of these materials?			
Check Materials Used	How many pages in total were students required to read?	How satisfied were you with these materials? Well-satisfied	Would like to change them	Definitely intend changing them	Did you prepare these materials? Yes	No	Total say	Selected them but had to verify with a chairperson or administrator	Was member of a group that selected them	Someone else selected them
☐ 1 Textbooks	_____ 13-15	16 ☐ 1	☐ 2	☐ 3	17 ☐ 1	☐ 2	18 ☐ 1	☐ 2	☐ 3	☐ 4
☐ 2 Laboratory materials and workbooks	_____ 19-21	22 ☐ 1	☐ 2	☐ 3	23 ☐ 1	☐ 2	24 ☐ 1	☐ 2	☐ 3	☐ 4
☐ 3 Collections of readings	_____ 25-27	28 ☐ 1	☐ 2	☐ 3	29 ☐ 1	☐ 2	30 ☐ 1	☐ 2	☐ 3	☐ 4
☐ 4 Reference books	_____ 31-33	34 ☐ 1	☐ 2	☐ 3	35 ☐ 1	☐ 2	36 ☐ 1	☐ 2	☐ 3	☐ 4
☐ 5 Journal and/or magazine articles	_____ 37-39	40 ☐ 1	☐ 2	☐ 3	41 ☐ 1	☐ 2	42 ☐ 1	☐ 2	☐ 3	☐ 4
☐ 6 Newspapers	_____ 43-45	46 ☐ 1	☐ 2	☐ 3	47 ☐ 1	☐ 2	48 ☐ 1	☐ 2	☐ 3	☐ 4
☐ 7 Syllabi and handout materials	_____ 49-51	52 ☐ 1	☐ 2	☐ 3	53 ☐ 1	☐ 2	54 ☐ 1	☐ 2	☐ 3	☐ 4
☐ 8 Problem books	_____ 55-57	58 ☐ 1	☐ 2	☐ 3	59 ☐ 1	☐ 2	60 ☐ 1	☐ 2	☐ 3	☐ 4
☐ 9 Other *(please specify)* _____	_____ 61-63	64 ☐ 1	☐ 2	☐ 3	65 ☐ 1	☐ 2	66 ☐ 1	☐ 2	☐ 3	☐ 4

10. Please indicate the emphasis given to each of the following student activities in this class.

	Not included in determining student's grade	Included but counted less than 25% toward grade	Counted 25% or more toward grade	
a. Papers written outside of class	☐1	☐2	☐3	67
b. Papers written in class	☐1	☐2	☐3	68
c. Quick-score/objective tests/exams	☐1	☐2	☐3	69
d. Essay tests/exams	☐1	☐2	☐3	70
e. Field reports	☐1	☐2	☐3	71
f. Oral recitations	☐1	☐2	☐3	72
g. Workbook completion	☐1	☐2	☐3	73
h. Regular class attendance	☐1	☐2	☐3	74
i. Participation in class discussions	☐1	☐2	☐3	75
j. Individual discussions with instructor	☐1	☐2	☐3	76
k. Research reports	☐1	☐2	☐3	77
l. Non-written projects	☐1	☐2	☐3	78
m. Homework	☐1	☐2	☐3	79
n. Laboratory reports	☐1	☐2	☐3	80
o. Laboratory unknowns and/or practical exams (quantitative and qualitative)	☐1	☐2	☐3	12
p. Problem sets	☐1	☐2	☐3	13
q. Other *(please specify):*_____	☐1	☐2	☐3	14

11. Examinations or quizzes given to students may ask them to demonstrate various abilities. Please indicate the importance of each of these abilities in the tests you gave in this course. (CHECK ONE BOX FOR EACH ITEM)

	Very important	Somewhat important	Not important	
a. Mastery of a skill	☐1	☐2	☐3	15
b. Acquaintance with concepts of the discipline	☐1	☐2	☐3	16
c. Recall of specific information	☐1	☐2	☐3	17
d. Understanding the significance of certain works, events, phenomena, and experiments	☐1	☐2	☐3	18
e. Ability to synthesize course content	☐1	☐2	☐3	19
f. Relationship of concepts to student's own values	☐1	☐2	☐3	20
g. Other *(please specify):*_____	☐1	☐2	☐3	21

12. What was the relative emphasis given to each type of question in written quizzes and examinations? (PLEASE RESPOND BY CHECKING ONE OF THE THREE BOXES FOR EACH ITEM.)

	Frequently used	Seldom used	Never used	
a. Multiple response (including multiple choice and true/false)	☐1	☐2	☐3	22
b. Completion	☐1	☐2	☐3	23
c. Essay	☐1	☐2	☐3	24
d. Solution of mathematical type problems where the work must be shown	☐1	☐2	☐3	25
e. Construction of graphs, diagrams, chemical type equations, etc.	☐1	☐2	☐3	26
f. Derivation of a mathematical relationship	☐1	☐2	☐3	27
g. Other *(please specify):*_____	☐1	☐2	☐3	28

13. What grading practice did you employ in this class?

ABCDF	☐ 1	29
ABCD/No credit	☐ 2	
ABC/No credit	☐ 3	
Pass/Fail	☐ 4	
Pass/No credit	☐ 5	
No grades issued	☐ 6	
Other _____ *(please specify)*	☐ 7	

14. For each of the following out-of-class activities, please indicate if attendance was required, recommended or neither.

	Attendance required for course credit	Attendance recommended but not required	Neither required nor recommended	
a. On-campus educational type films	☐ 1	☐ 2	☐ 3	30
b. Other films	☐ 1	☐ 2	☐ 3	31
c. Field trips to industrial plants, research laboratories	☐ 1	☐ 2	☐ 3	32
d. Television programs	☐ 1	☐ 2	☐ 3	33
e. Museums/exhibits/zoos/arboretums	☐ 1	☐ 2	☐ 3	34
f. Volunteer service on an environmental project	☐ 1	☐ 2	☐ 3	35
g. Outside lectures	☐ 1	☐ 2	☐ 3	36
h. Field trips to natural formation or ecological area	☐ 1	☐ 2	☐ 3	37
i. Volunteer service on education/ community project	☐ 1	☐ 2	☐ 3	38
j. Tutoring	☐ 1	☐ 2	☐ 3	39
k. Other *(please specify)*: _____	☐ 1	☐ 2	☐ 3	40

15a. Was this class conducted as an interdisciplinary course?

Yes	☐ 1	41
No	☐ 2	

b. IF YES: Which other disciplines were involved? _____
(please specify)

_____

_____ 42-
43-

16. Were instructors from other disciplines involved . . .

	YES	NO	
. . . in course planning?	☐ 1	☐ 2	44
. . . in team teaching?	☐ 1	☐ 2	45
. . . in offering guest lectures?	☐ 1	☐ 2	46

17a. Which of these types of assistance were available to you last term? CHECK AS MANY AS APPLY.

b. Which did you utilize? CHECK AS MANY AS APPLY.

	a. Assistance was available to me in the following areas	b. Utilized
a. Clerical help	47- ☐1	48- ☐1
b. Test-scoring facilities	☐2	☐2
c. Tutors	☐3	☐3
d. Readers	☐4	☐4
e. Paraprofessional aides/instructional assistants	☐5	☐5
f. Media production facilities/assistance	☐6	☐6
g. Library/bibliographical assistance	☐7	☐7
h. Laboratory assistants	☐8	☐8
i. Other *(please specify):*_____	☐9	☐9

18. Although this course may have been very effective, what would it take to have made it better? CHECK AS MANY AS APPLY.

a. More freedom to choose materials	☐1	49
b. More interaction with colleagues or administrators	☐2	
c. Less interference from colleagues or administrators	☐3	
d. Larger class (more students)	☐4	
e. Smaller class	☐5	
f. More reader/paraprofessional aides	☐6	
g. More clerical assistance	☐7	
h. Availability of more media or instructional materials	☐8	
i. Stricter prerequisites for admission to class	☐9	
j. Fewer or no prerequisites for admission to class	☐1	50
k. Changed course description	☐2	
l. Instructor release time to develop course and/ or material	☐3	
m. Different goals and objectives	☐4	
n. Professional development opportunities for instructors	☐5	
o. Better laboratory facilities	☐6	
p. Students better prepared to handle course requirements	☐7	
q. Other *(please specify):*_____	☐8	

Now, just a few questions about you . . .

19. How many years have you taught in any two-year college? 51

- a. Less than one year . . . . . ☐ 1
- b. 1-2 years . . . . . ☐ 2
- c. 3-4 years . . . . . ☐ 3
- d. 5-10 years . . . . . ☐ 4
- e. 11-20 years . . . . . ☐ 5
- f. Over 20 years . . . . . ☐ 6

20. At this college are you considered to be a: 52

- a. Full-time faculty member . . . . . ☐ 1
- b. Part-time faculty member . . . . . ☐ 2
- c. Department or division chairperson . . . ☐ 3
- d. Administrator . . . . . ☐ 4
- e. Other *(please specify):*

  _____ . . . ☐ 5

21a. Are you currently employed in a research or industrial position directly related to the discipline of this course? 53

Yes ☐ 1
No ☐ 2

b. IF YES: For how many years?_____ 54/55

c. If previously you had been employed in a related industry or research organization, please indicate the number of years:_____ 56/57

22. What is the highest degree you presently hold? 58

- a. Bachelor's . . . . . ☐ 1
- b. Master's . . . . . ☐ 2
- c. Doctorate . . . . . ☐ 3

IMPORTANT INSTRUCTIONS

Thank you for taking the time to complete this survey. Please seal the completed questionnaire in the envelope which is addressed to the project facilitator on your campus and return it to that person. After collecting the forms from all participants, the facilitator will forward the sealed envelopes to the Center.

We appreciate your prompt attention and participation in this important survey for the National Science Foundation.

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Florence B. Brawer
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